(19) Japan Patent Office (JP)

(12) Patent Application Laid-open (A)

(11) Publication: Hei-4-182650

(43) Date of Publication of Application: June 30, 1992

(54) Title of the Invention: POSITIVE PHOTOSENSITIVE COMPOSITION AND PRODUCING METHOD FOR MICROLENS

(21) Patent Application: Application Number Hei-2-312413

(22) Application Date: November 17, 1990

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Specification

1. Title of the Invention

POSITIVE PHOTOSENSITIVE COMPOSITION AND PRODUCING METHOD FOR MICROLENS

2. Claims

(1) A positive-working photosensitive composition, principally constituted of a chlorobenzaldehyde-diphenoxyethylacetal compound, a cresol novolak resin and a 2-alkoxyphenyl-4,6-bis(trichloromethyl)-s-triazine compound which sublimes by heating at 100 to 160°C and generates an acid by an action of an ultraviolet light.

(2) A producing method for a microlens having a refractive index of 1.60 or higher, comprising steps of coating a positive working photosensitive composition according to claim 1 on a substrate, executing a drying at 100°C or lower, executing an exposure with an ultraviolet light followed by a development with alkaline water to form a pattern of a designated dimension, then heating at 100 to 160°C to cause the pattern to flow down from the top thereby forming a convex lens, and to irradiate a far ultraviolet light to fix the convex lens.

3. Detailed Description of the Invention

The present invention relates to a positive working photosensitive composition of a high sensitivity for producing a micro optical lens member and a microlens array formed by a regular array of micro lens members, to be used in a solid-state image pickup device and a liquid crystal display, and a producing method for a microlens.

JP-A-2-189501 discloses a method of heat treating a coated film, principally constituted of fine silica particles and an organic silane compound, thereby regulating a dense structure and a curing degree, then pressing a lens mold bearing a lens shape in advance, then executing a heating in such state to completely cure the coated film and detaching the lens mold

after the complete curing of the film thereby preparing a microlens.

The lens member obtained in such method does not require a polishing process and can be prepared in a simple manner, but the precision of microlens is insufficient.

Thus the on-chip microlens is produced by precisely patterning a positive resist, then causing a thermal flow thereof, and transferring the shape to an underlying transparent resin layer by an etching step utilizing oxygen plasma, but, depending on the oxygen plasma resistance of the transparent resin layer, a side etching may take place to degrade the shape of microlens or to affect the transfer, whereby the shape of the microlens may be difficult to control. Also a larger refractive index of the material constituting the microlens allows to make the transparent resin layer thinner, but there is involved a drawback that the performance of the microlens is influenced by the refractive index, heat resistance, light resistance, solvent resistance and the like of the transparent resin layer.

Also the method of producing a microlens by pressing a lens mold, then executing a heating and detaching the lens mold after complete curing can produce the microlens in a simple process, but, in consideration of optical refraction, cannot be considered to fully exploit the performance of the

microlens.

Therefore, the present invention is to provide a producing method for a microlens of a high precision, having a large refractive index, a heat resistance, a light resistance and a solvent resistance in a short process. The present invention is also to provide a positive photosensitive composition of a high sensitivity, to be employed in such producing method.

The present inventors have found that a halogen introduction into a benzene ring of benzaldehyde has increased the refractive index, and have tried a reaction utilizing chlorobenzaldehyde, bromobenzaldehyde or iodobenzaldehyde as the raw material with phenoxyethyl alcohol, and have tried to produce a microlens by preparing a positive photosensitive composition, by mixing an obtained acetal compound and a cresol novolak resin. As a result, bromobenzaldehyde-diphenoxyethylacetal and iodobenzaldehyde-diphenoxyethylacetal are slow in sensitivity and generate a large amount of development residue.

As chlorobenzaldehyde has a melting point as the raw material increasing in the order of 11°C in o-isomer, 17 to 18°C in m-isomer and 47°C in p-isomer, chlorobenzaldehyde-diphenoxyethylacetal compound also shows a correspondingly increasing melting point, with a melting

point of 62 to 64°C in p-chlorobenzaldehyde-diphenoxyethylacetal.

A coated and dried film of a positive photosensitive composition, formed by mixing p-chlorobenzaldehyde-diphenoxyethylacetal and a cresol novolak resin has a refractive index as large as 1.65, in contrast to 1.54 in glass.

As a heat resistance is required for microlenses, the acetal compound to be employed preferably has a melting point as high as possible, as long as the patterning is not affected.

Examples of 2-alkoxyphenyl-4,6-(trichloromethyl)-s-triazine compound which sublimes by heating at 100 to 160°C and generates an acid by an action of an ultraviolet light, to be employed in the present invention, include 2-(p-methoxyphenyl)-4,6-bis(trichloromethyl)-s-triazine, 2-(p-ethoxyphenyl)-4,6-bis(trichloromethyl)-s-triazine, and 2-(p-propoxyphenyl)-4,6-bis(trichloromethyl)-s-triazine.

A mixing ratio of cresol novolak resin and chlorobenzaldehyde-diphenoxyethylacetal compound, employed in the present invention, is preferably within a range of from 2.5 : 1 to 3.5 : 1. An increased amount of chlorobenzaldehyde-diphenoxyethylacetal compound increases

unevenness in coating, thus becoming deficient in the uniformity of the film. On the other hand, a decreased amount enhances a film thickness loss in the development with alkaline water, thus reducing the film retention rate.

The 4-alkoxyphenyl-2,6-di(trichloromethyl)-s-triazine compound to be employed in the present invention is preferably added within a range of from 1.5 to 4 % with respect to chlorobenzaldehyde-diphenoxyethylacetal compound. An amount exceeding 4 % induces a thermal fog, thereby generating residues at the development, and an amount of 1.5 % or less reduces the sensitivity of the positive resist.

In the photosensitive composition of the present invention, there may be added ordinary additives such as a fluorinated surfactant serving as a stabilizer and a leveling agent, and an antihalation dye within the range not departing from the spirit of the invention.